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Original Contributions

EARLY EXCLUSION OF MAJOR ADVERSE CARDIAC EVENTS IN EMERGENCY DEPARTMENT CHEST PAIN PATIENTS: A PROSPECTIVE OBSERVATIONAL STUDY

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☐ **Abstract—Background: The current evaluation of patients with chest pain presenting to an emergency department (ED) with suspected acute coronary syndrome (ACS) is a lengthy process involving serial measurements of troponin. Objective: We aimed to validate the diagnostic accuracy of a Thrombolysis in Myocardial Infarction (TIMI) score with single high-sensitive cardiac troponin T (hs-cTnT) for early rule out of 30-day major adverse cardiac events (MACE), and to compare the TIMI score with combinations of heart-type fatty acid binding protein (H-FABP) and a modified HEART (history, electrocardiogram, age, risk factors, troponin) score. Methods: We recruited 602 consecutive adult patients with chest pain and suspected ACS in the ED. Each patient had TIMI and HEART scores, and a point-of-care H-FABP test. Results: MACE occurred in 42 (7.0%) patients within 30 days. A low risk for 30-day MACE was identified by a modified TIMI score of 0 in 65 (11%) patients, and by a HEART score ≤ 2 in 96 (16%) patients. No MACE occurred in these groups, giving both scores a sensitivity of 100% (95% confidence interval [CI] 91.6–100%), and specificity of 11.6% (95% CI 9.2–14.5%) and 17.1% (95% CI 14.2–20.5%), respectively. Use of combined TIMI and HEART scores improved the specificity further to 22.0% (95% CI 18.7–25.6%) without lowering sensitivity. Early H-FABP measurement > 7 μg/L had a sensitivity of 41.5% (95% CI 27.8–56.6%) and a specificity of 91.1% (95% CI 88.4–93.2%) for predicting 30-day MACE. Conclusions: A modified TIMI score of 0 or a HEART score of ≤ 2, incorporating a single hs-cTnT level, will identify patients with low risk of 30-day MACE for early discharge within 2 h of ED arrival.** © 2017 Elsevier Inc. All rights reserved.

☐ **Keywords—acute coronary syndrome; chest pain; diagnosis; major adverse cardiac event**

INTRODUCTION

Chest pain is one of the most common complaints in patients presenting to emergency departments (ED) globally, representing 2.5% of all ED presentations in Hong

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Kong (1–3). Acute coronary syndrome (ACS) cannot be immediately excluded in the majority of patients presenting with chest pain, and is confirmed in about 15–25% cases. The current evaluation of patients in most EDs is a lengthy process that involves serial electrocardiograms (ECGs) and troponin tests taken 3–6 h apart (4). However, challenges of ED crowding and the need for acceptable risk stratification have prompted the search for safe, inexpensive but effective accelerated chest pain pathways (4–7).

Risk-stratification tools that predict a very low risk of major adverse cardiac events (MACE) may be more clinically relevant to the ED specialist than precise diagnostic labels. In the Asia-Pacific region, a 2-h diagnostic protocol involving serial point-of-care biomarkers, such as troponin I, creatine kinase MB, and myoglobin, combined with ECG changes and a Thrombolysis in Myocardial Infarction (TIMI) score, has been shown to safely exclude 30-day MACE in low-risk patients with chest pain (4,5,8,9). High-sensitivity troponin T (hs-cTnT) and high-sensitivity troponin I tests perform well in the early diagnosis of acute myocardial infarction (AMI), non-ST elevation myocardial infarction (NSTEMI), and in the prediction of 2-year mortality (10–12).

Despite evidence favoring early rule-out pathways, there is still a need for further validation and refinement of such tools using different diagnostic pathways, in other clinical settings, evaluating other potential markers, such as heart-type fatty acid binding protein (H-FABP), and with other clinical tools, such as HEART (history, electrocardiogram, age, risk factors, troponin) score (13–17).

H-FABP is thought to be superior to creatine kinase-MB or cardiac troponins in early detection of ischemic myocardial necrosis (18).

In this study, we aimed first to validate an early TIMI score with hs-cTnT to rule out 30-day MACE, and second to compare this with H-FABP, a modified HEART score, and their combined use. Applying this protocol in clinical practice has the potential to reduce ED waiting times, ED crowding, and hospital admission rates for chest pain patients. This is a substudy of a prospective observational study of adult patients with potentially cardiac chest pain who underwent computer tomography (CT) scan to evaluate the usefulness of coronary calcium score in risk-stratifying chest pain patients.

METHODS

Study Design

We conducted a prospective study between March 4, 2013 and March 31, 2014 in the ED of a tertiary referral university hospital in Hong Kong. The study is registered with ClinicalTrials.gov (no. NCT02364271). Ethical approval was obtained from the joint Institutional Review Board of the Chinese University of Hong Kong and Prince of Wales Hospital. Written informed consent was taken from all participants, and the study complied fully with the Declaration of Helsinki and Good Clinical Practice Guidelines (19,20). The ED has approximately 150,000 new patient registrations every year, with an admission rate of 34%, and mean waiting times to see a doctor in the ED of > 4 h during the busiest winter surges. Hospital bed occupancy frequently exceeds 100%.

Participants

The study included consecutive eligible patients presenting to the ED from 9 AM to 4 PM from Monday to Friday. We included patients who had chest or epigastric pain within 24 h before ED presentation, symptoms suggestive of cardiac chest pain, and for whom hs-cTnT measurement was requested by the assessing emergency physician. Patients were excluded if STEMI or ACS was confirmed immediately on ED arrival, or if there was hemodynamic instability, pregnancy, age younger than 18 years, or unable to obtain informed consent. Data collection commenced at triage. The funding for this study involved ED assessments for the role of CT calcium scoring to rule in ACS and MACE, so we excluded patients if they had a pacemaker or any metal device implantation, or if there was previous coronary artery bypass grafting or percutaneous coronary intervention. With this exclusion criteria and the recruitment in ≤ 8 h/d and working days only, the number of subjects included is not very high. Only 1 patient was lost in the 30-day telephone follow-up and was excluded from the analysis.

Measurements

Data collected by research staff included patient characteristics, medical history, conventional risk factors, and current medication. An ECG and serial hs-cTnT (Elecsys Troponin T hs; Roche Diagnostics, Germany; upper reference limit [99th percentile], 14 ng/L) are part of the chest pain protocol in our hospital and all results were obtained from the hospital laboratory within about 1 h of sampling. The H-FABP point-of-care (POCT) test (Shenzhen Kang Sheng Bao Bio-technology Co., Ltd; upper reference limit [99th percentile], 7 μg/L) was performed at the same time blood was withdrawn for hs-cTnT. The research staff obtained the hs-cTnT results from the hospital central laboratory, performed the H-FABP measurement, and scored the TIMI and HEART charts for all patients. We recorded a negative response if the patient was unsure of an answer to a question (e.g., family history of cardiac disease). Serial hs-cTnT